

INTRODUCTION

Water potential readings are a useful tool for determining the water stress of trees under drought conditions. Irrigated blue gum clones have been shown to have midday water potential readings of ~ -6 bar for 25% shaded and ~-12 bar for full sun, and -23 to -32 bar for water stressed clones 7 weeks after cessation of irrigation (Costa e Silva et al., 2004). Albany Hill Park eucalyptus water stress measurements were taken on two days during 2021: 1) June 21, predawn and midday measurements of water potential 2) August 11, midday measurements of water potential.

METHODS

Water potential was measured for six blue eucalyptus (*Eucalyptus globulus*) on June 21, 2021 predawn (0400-0530) and midday (1200-1330) using a PMS Instruments 615 pressure chamber. Three were sampled at the summit and three were sampled downslope. For each tree a single branch 2-3 ft. long was clipped and 3 subsampled from each branch were measured. The summit trees had significant crown decline and have tags. The downslope trees did not have obviously declining crowns and one had a heavy capsule crop. On August 11 stem water potential of five trees were measured using a PMS Instruments model 1000 pressure chamber at midday (1500-1611). Three trees were sampled at the summit and two were sampled downslope. Three measurements were taken on each tree. On the summit epicormic stems were bagged with a plastic zip sealing bag which was covered with a reflective mylar zip sealing bag. One tree was also sampled using the method of June 21 for comparison. At the downslope site two of the trees sampled in June were resampled using the bag method, the third tree did not have branches within reach. Between tree and between site differences were evaluated using an unpaired t-test. In both June and August the summit trees had obviously declining crowns, with scattered browning leaves, full limb dieback, and no obvious seed capsule formation. The downslope trees had much fuller crowns, few brown leaves, and one tree had a large seed capsule crop.

RESULTS

June 21, 2021

Predawn water potential results: One downslope tree (370) was under mild stress as indicated by the high predawn reading (avg. -6.33 bar) and the other five trees had significantly higher stress levels (avg. -14.75, $p=0.0001$) (table 1). The average water potential of the summit trees vs. the downslope trees was 14.1 vs. 11.0 ($p=0.01$) The foliage of the less water stressed tree was similar in appearance to the other two downslope trees but had a heavy load of maturing capsules. None of the summit samples were setting capsules and one other downslope tree had a few scattered capsules.

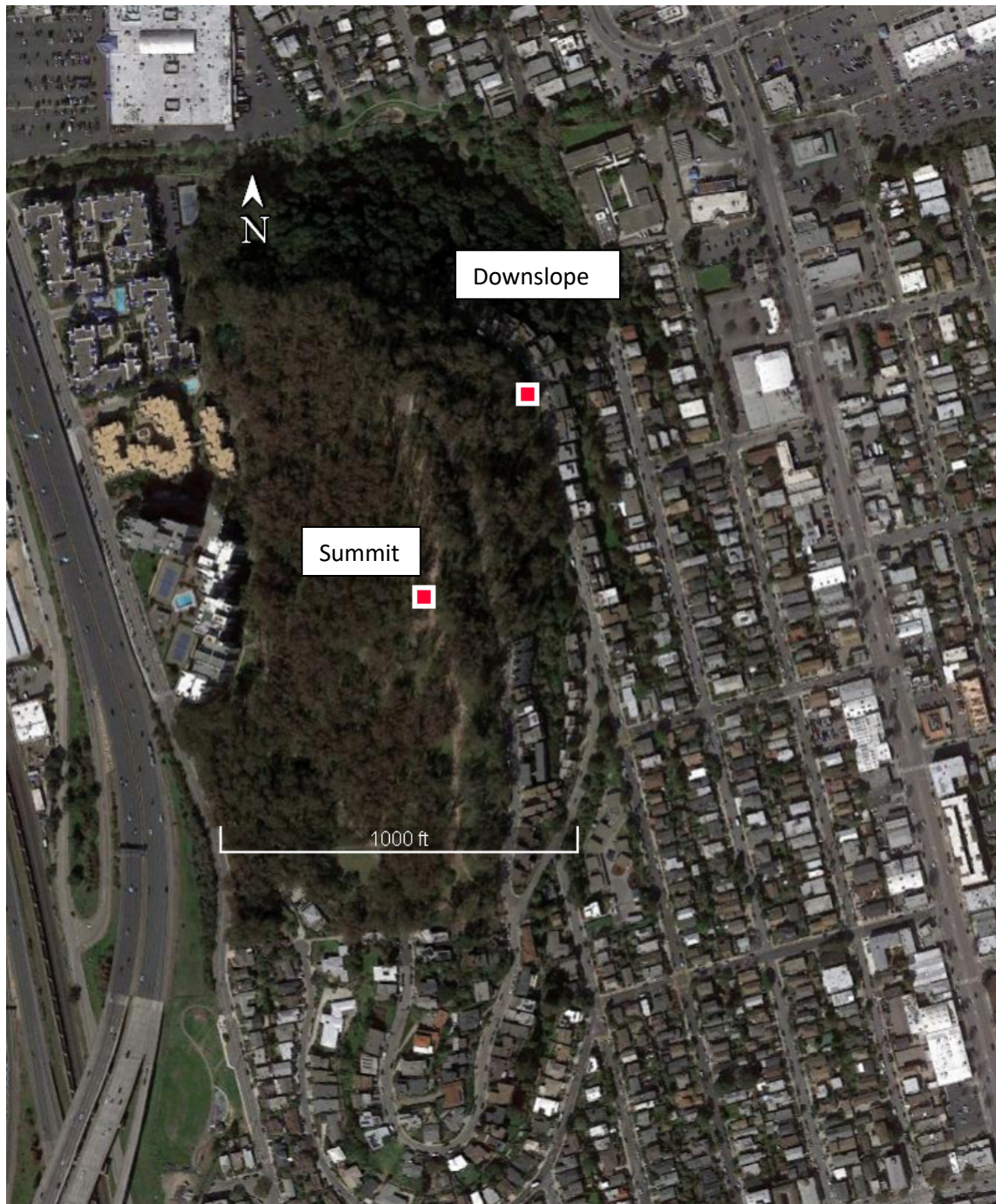
Midday water potential results: The average of the summit trees was 24.5 summit vs. 22.5 downslope and the difference was not statistically significant ($p=0.07$) (table 1). Tree 370 was more similar to the other trees compared to the predawn measurements, but was still significantly different in all pairwise comparisons with the other 5 trees ($p=0.003$ to 0.039)

August 11, 2021

Midday water potential results: Stress levels were higher than the midday June readings for all of the trees except downslope tree 370. Water stress levels for tree 370 were 2x the level reported for shaded irrigated clones and consistent with full sun irrigated trees (Costa e Silva et al., 2004) and 1/2-1/3 the water stressed trees, indicating mild water stress. It is probably that tree 370 has deep root

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development allowing it to access sufficient water. The adjacent tree, 369, showed levels of water stress significantly lower than the summit trees ($p=0.0002$ to 0.003) and significantly higher than tree 370 ($p=0.0001$). The average of the 3 summit trees, -30.8 bar, was significantly higher than the average of the two downslope trees, -16.4 bar, $p=0.0001$.



Albany Hill Park: Summit eucalyptus with browning canopies. Downslope eucalyptus with green crowns.

RESULTS

Site	Tag	Predawn (- bar)	Midday (-bar)	Notes
Summit	230	17.0	24.0	
	230	17.5	24.0	
	230	16.5	24.0	
	156	17.0	23.0	
	156	20.0	23.0	
	156	16.5	23.5	
	233	10	25.0	
	233	12	26.0	
	233	NA	28.0	Branch mostly brown, only two green areas available
Downslope	369	11	25.5	
	369	14	24.5	
	369	14.5	26.0	
	370	6.0	18.5	Heavy capsule crop and lots of new growth
	370	6.5	20.5	
	370	6.5	20.5	
		14.5	23.5	A few scattered capsules forming
		13.5	21.5	
		12.5	22.5	

Table 1 June 21, 2021 PMS results.

Site	Tag or WP	Predawn (- bar)	Midday (-bar)	Notes
Summit	WP292	NA	32.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP292	NA	31.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP292	NA	31.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP293	NA	31.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP293	NA	30.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP293	NA	32.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP294	NA	29.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP294	NA	29.0	Epiphytic bole sprout, bagged for 1-1.5 hrs.
	WP294	NA	28.5	Epiphytic bole sprout, bagged for 1-1.5 hrs.
Downslope	369	NA	23.0	Branch tip on low hanging branch, bagged for 1-1.5 hrs
	369	NA	23.5	Branch tip on low hanging branch, bagged for 1-1.5 hrs
	369	NA	21.5	Branch tip on low hanging branch, bagged for 1-1.5 hrs
	370	NA	11.0	Branch tip on low hanging branch, bagged for 1-1.5 hrs
	370	NA	10.0	Branch tip on low hanging branch, bagged for 1-1.5 hrs
	370	NA	9.5	Branch tip on low hanging branch, bagged for 1-1.5 hrs
		NA	NA	Not Sampled: no vegetation within reach for bagging

Table 2 August 11, 2021 PMS results.

Table 3: August 11 summit tree way points

Way Point	Latitude	Longitude
292	37.8949	-122.3045
293	37.8945	-122.3049
294	37.8954	-122.3049

Figure 1: Graph showing PMS readings for blue gum clones during a 7 week drought experiment. Results expressed in megapascals (MPa=bar/10) (Costa e Silva et al., 2004)

Time zero is full sun clones, (approx. -12 bar). Clones then placed in 25% shade house (approx. -6 bar). Well-watered (WW) clones were irrigated and water-stressed (WS) were not. Clone CN5 was more drought tolerant.

